

NOTES ON THE FROG GENUS *CYCLORAMPHUS*
(AMPHIBIA: LEPTODACTYLIDAE), WITH
DESCRIPTIONS OF TWO NEW SPECIES

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Abstract.—Examination of the types of *Telmatobius duseni* Andersson indicates that a new name is required for the taxon previously referred to as *Cycloramphus duseni*. The name *Cycloramphus izecksohni* is proposed for this taxon. A second new species, *Cycloramphus cedrensis*, is described for material recently collected near Rio dos Cedros, Santa Catarina, Brazil. New distributional data are reported for *Cycloramphus valae* and the advertising call and larva of *C. valae* are described for the first time.

Information has recently become available that extends our knowledge of the systematics and natural history for members of the frog genus *Cycloramphus*. The purpose of this paper is to report these data, which augment those presented in a recent revision (Heyer 1983).

Materials and Methods

Morphological data were taken and are reported on in a standard manner (e.g., Heyer 1983). Advertisement calls were recorded on a Sony TCM-280 cassette recorder using a Sennheiser K30 microphone. Calls were analyzed on a Kay Sonagraph 6061B, narrow filter, AGC in the off position. Call parameters are based on analysis of 5 calls of *C. cedrensis* and 3 calls each of *C. valae* from the two localities reported.

The Identity of *Telmatobius duseni* Andersson

I had the opportunity to examine two syntypes of *Telmatobius duseni* after my previous study (Heyer 1983) was completed. In that study, the name *duseni* was applied to specimens mostly from the State of Santa Catarina, with one outlier locality in the State of São Paulo (Heyer 1983: fig. 42). Examination of the types of *T. duseni* indicates they do not represent the species I referred to as *duseni*.

The types show that *duseni* is a member of the *C. fuliginosus* group; that is, the species has toe webbing and dorsal warts and tubercles (Fig. 1). They further resemble the species previously referred to as *C. duseni* and differ from all other members of the *C. fuliginosus* group in small size (types of *T. duseni* males 31.3, 33.5 mm SVL), in having a dorsum with shagreen and tubercles with the large tubercles sometimes arranged in regular rows (as in Fig. 1), and the posterior surface of the thigh with distinct light spots (as in Fig. 1). The types of *T. duseni* differ significantly from the species previously referred to as *C. duseni* in the amount of toe webbing. The types of *T. duseni* have reduced webbing (webbing formula of right foot of lectotype: I trace II $1\frac{3}{4}$ -3⁺ III $2\frac{1}{4}$ -3 $\frac{1}{2}$ IV $3\frac{1}{3}$ -2⁺ V), the species previously referred to as *C. duseni* has moderate toe webbing. The web-

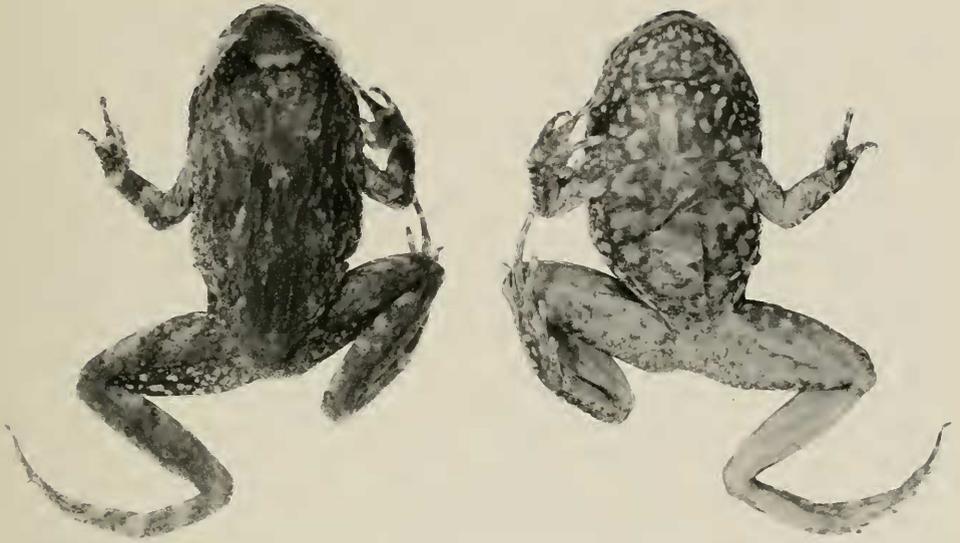


Fig. 1. Lectotype of *Telmatobius duseni* Andersson, dorsal and ventral views.

bing formula for the outer side of toe IV in the types of *T. duseni* ranges from $3\frac{1}{2}$ to 4^- , whereas webbing in the species previously referred to as *C. duseni* ranges from $2\frac{1}{2}$ to 3^+ , as an example. Such a difference is indicative of species level differentiation in the genus *Cycloramphus* (Heyer 1983).

At present, the species *Cycloramphus duseni* (Andersson) is known only from the type series. The type locality, "Brazil, Parana, Sierra do mar; Ypiranga, in crevices and cracks in the vertical cliffs along the railway, 3/9 1911," (Andersson 1914:2) was incorrectly plotted in the review paper (Heyer 1983) as discussed in Heyer and Maxson (1983). In order to clarify the precise locality where Dusén collected the specimens named by Andersson, Dr. P. E. Vanzolini kindly made arrangements for me to interview officials of the Rede Ferroviária Federal S/A in Curitiba, Paraná. At the railroad office I learned that there is no railway station named Ipiranga on the railway line from Curitiba to Paranaguá. Rather, Dusén collected at Casa Ipiranga, a house on the railway line where the railroad construction engineers lived during the railroad line construction. The Casa Ipiranga today is a state historical preservation site (patrimônio), that can be reached only by railroad. Although Casa Ipiranga is not a regular railroad stop, the officials of the railway arranged an overnight visit for me on 7 January 1982. Vertical cliffs where water was seeping and dripping were found along the railway line. No *Cycloramphus* were found at night along the vertical cliffs or along the stream near the house. The habitat looked suitable for *Cycloramphus*; a longer trip earlier in the wet season would likely yield positive results.

For nomenclatural stability, I hereby designate the 31.3 mm SVL specimen, Naturhistoriska Riksmuseet, Stockholm No. 1606 (Fig. 1), as the lectotype of *Telmatobius duseni* Andersson. The Stockholm Museum has two of the original series of five specimens. One specimen was exchanged with the British Museum and two specimens are apparently lost (Bengt-Olov Stolt, pers. comm.). Addi-

tional characteristics of the lectotype, not apparent in the photograph (Fig. 1) or mentioned above are: thumb lacking asperities; snout sloping in profile (Heyer 1983: fig. 6C); distinct inguinal disk; head length 12.4 mm; head width 13.9 mm; eye–nostril distance 2.6 mm; eye–eye distance 5.9 mm; femur length 15.6 mm; tibia length 15.8 mm; foot length 16.0 mm.

Subsequent to my visit to the type locality of *duseni* at Casa Ipiranga, Werner C. A. Bokermann informed me that he had collected at Bahado, the nearest regular train station to Casa Ipiranga on the line from Paranaguá to Curitiba. I had not seen these *Cycloramphus* previously, so Bokermann loaned them to me for purposes of this paper. The specimens (which include two males 37.4 and 41.4 mm SVL) are *C. rhyakonastes*, the only known species of *Cycloramphus* to have red bellies in life. Andersson (1914:2) gives the belly color of *T. duseni* as “yellowish dirty white,” but it is not apparent from the description whether these are life colors or those in preservative when Andersson described them. The types of *T. duseni* are similar to *Cycloramphus rhyakonastes* in dorsal texture, posterior thigh surface pattern and foot webbing (the reduced webbing of *T. duseni* is matched by some individuals of *C. rhyakonastes*). The types of *T. duseni* differ from *C. rhyakonastes* males in being smaller (males of *T. duseni* 31–37 mm SVL; males of *C. rhyakonastes* 37–50 mm). The size difference, probable differences in life belly color, and habitat (*C. rhyakonastes* have only been collected along streams, not on rock wall seeps) suggest that *duseni* and *rhyakonastes* represent two distinct species. Thus I prefer to recognize *duseni* and *rhyakonastes* as valid species of *Cycloramphus*, pending the availability of fresh topotypic material of *duseni*.

Cycloramphus duseni (Andersson) will key out to couplet 16 in the key to species published previously (Heyer 1983). The smaller size of *C. duseni* distinguishes it from both *C. rhyakonastes* and *semipalmatus*, the species contrasted in that couplet.

A New Name for the Form Previously Referred to as *Cycloramphus duseni*

The species previously referred to as *C. duseni* (Heyer 1983; Heyer and Maxson 1983) is not the same form represented by the types of *Telmatobius duseni* Andersson. There is no available name for the species, so it is described as:

Cycloramphus izecksohni, new species

Fig. 3

Holotype.—Museu de Zoologia, Universidade de São Paulo (MZUSP) 57775, an adult male from Brazil; Santa Catarina, 13 km W Pirabeiraba, 26°12'S, 49°07'W. Collected by Annelise Gehrau and W. Ronald Heyer on 17 December 1978.

Paratopotypes.—MZUSP 57772–74, 57776–98; USNM 217869–96, 217931.

Referred specimens: All other specimens listed in the distribution section in the species account for *C. duseni* for the States of Santa Catarina and São Paulo in Heyer (1983).

Diagnosis.—The species with toe webbing and distinctly black and/or white dorsal tubercles that might be confused with the new form are *C. asper*, *bora-*

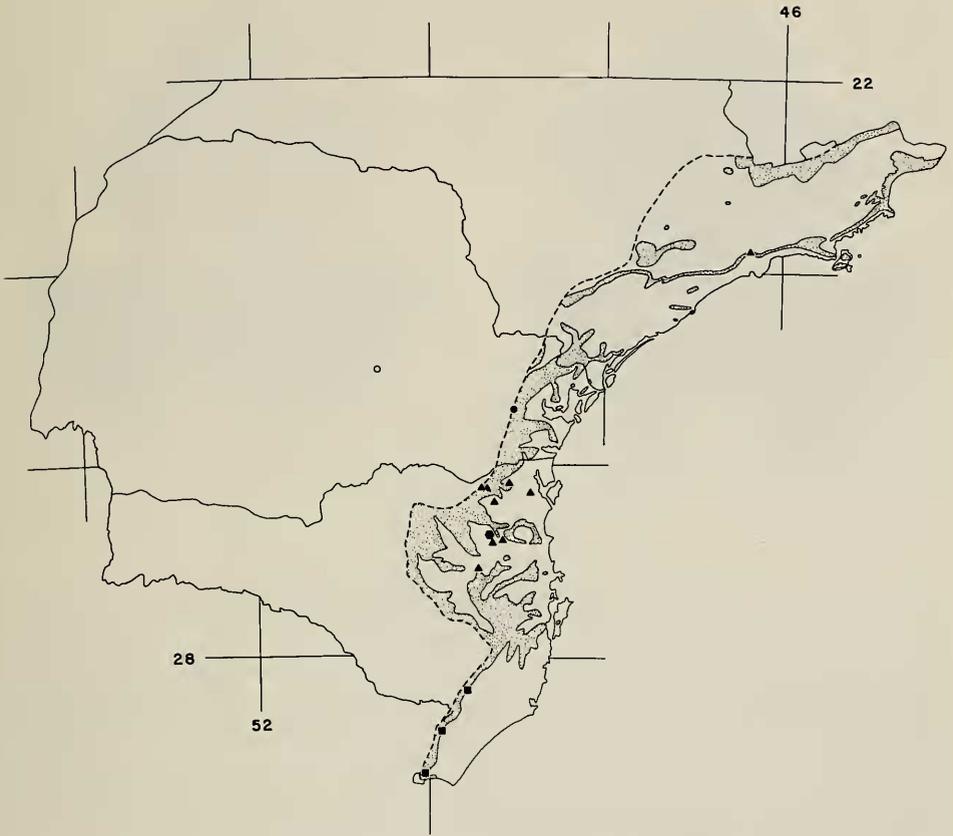


Fig. 2. Map of several *Cycloramphus* distributions in the States of São Paulo, Paraná, and Santa Catarina, Brazil. Base map is adapted from predicted areas of stream associated *Cycloramphus* distributions (Heyer and Maxson 1983). Dashed line is approximate east boundary of the Atlantic Forest Morphoclimatic Domain. Stippled areas are zones of sharp relief within the Atlantic Forest Morphoclimatic Domain where mountain brooks would be expected. Open circle is previously plotted (Heyer 1983) type locality of *Telmatobius duseni*. Solid circle is correct type locality of *T. duseni*. Triangles are known localities for *Cycloramphus izecksoni*, new species. Hexagon is only known locality for *Cycloramphus cedrensis*, new species. Squares are known localities for *Cycloramphus valae*.

ceienseis, *cedrensis*, *duseni*, *lutzorum*, *mirandaribeiroi*, *ohausi*, *rhyakonastes*, and *semipalmatus*. *Cycloramphus izecksohni* differs from *C. ohausi* in lacking thumb spines. The moderate web of *C. izecksohni* differentiates it from the forms with reduced webbing (*C. duseni*, *rhyakonastes* and *semipalmatus*) or considerable webbing (*asper*, *cedrensis* and *mirandaribeiroi*). *Cycloramphus izecksohni* is smaller (males 29–38 mm, females 31–44 mm SVL) than *asper*, *boraceienseis*, *lutzorum*, *mirandaribeiroi*, and *rhyakonastes* (smallest male 35.9 mm, smallest female 42.6 mm SVL).

Description of holotype.—Snout rounded from above and in profile; canthus rostralis indistinct; loreal slightly concave in cross section; tympanum hidden;

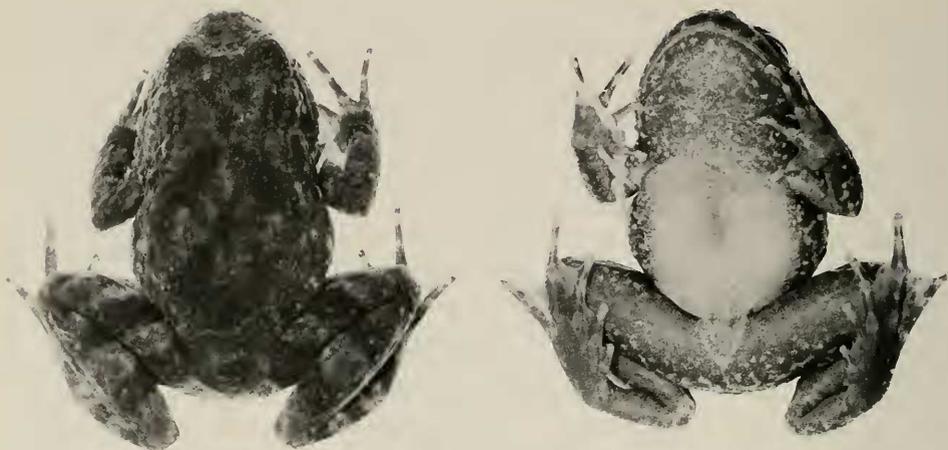


Fig. 3. Holotype of *Cycloramphus izecksohni*, dorsal and ventral views.

vomerine teeth in transverse series almost in medial contact, between and posterior to choanae; vocal fold present, but vocal slits absent; first finger just shorter than second; outer metacarpal tubercle a rounded square with an inner anterior projection, inner metacarpal tubercle ovoid, separated from subarticular tubercle of thumb by about diameter of subarticular tubercle; thumb lacking asperities; dorsal texture with shagreen and small to large warts each bearing a keratinized brown or black tubercle; large warts and tubercles arranged in short symmetrical rows behind the eyes; weak fold over ear region; inguinal gland large, disk-shaped, diameter between $\frac{1}{4}$ and $\frac{1}{3}$ femur length; venter weakly granular; toe tips just wider than digits; toes moderately webbed, I 1-2⁻ II 1-2⁺ III 1⁺-2 $\frac{1}{4}$ IV 2 $\frac{1}{2}$ -1 V; toe subarticular tubercles moderately developed; outer metatarsal tubercle round, smaller than large ovoid inner metatarsal tubercle; no tarsal or metatarsal folds; outer tarsus covered with small tubercles, sole of foot smooth.

SVL 34.9, head length 12.8, head width 14.5, eye-nostril, distance 3.3, eye-eye distance 6.6, femur 17.4, tibia 17.3, foot 17.8 mm.

In preservation, dorsum brown with slightly darker brown amorphous blotches, broad lighter interorbital band; loreal and upper lip region with three ill-defined light vertical stripes; upper limbs barred; throat, chest, and under sides of limbs brown with irregular white spots and marks, belly mostly cream with some brown punctations; posterior surface of thigh mostly uniform brown with a few small distinct light spots.

Eymology.—Named for Professor Eugênio Izecksohn, who has contributed much to the understanding of the anuran fauna of Brazil and who has consistently helped my research efforts.

The data for adult specimens, advertising call, and larval description are presented elsewhere (Heyer 1983, as *C. duseni*).

The currently known distribution of *C. izecksohni* centers on the northern portion of the Atlantic Forests in the State of Santa Catarina (Fig. 2). There are three specimens of this species (Museu Nacional, Rio de Janeiro 98) with the locality data of Alto da Serra, Santos, São Paulo. This locality (Fig. 2, locality

in State of São Paulo) does not make zoogeographic sense according to the scheme proposed by Heyer and Maxson (1983). However, there is no reason to doubt the veracity of the data and, there is unfortunately little likelihood of verification of this species at that locality. In the hundreds of preserved specimens examined from the area of Alto da Serra, only one small juvenile was found that might represent *C. izecksohni* (MZUSP 13909). Today, much of the area has been deforested by pollution from steel mills.

A New Species of *Cycloramphus* from Santa Catarina

One of the purposes of the field trip of 1982 was to test the accuracy of predictions as to areas of distribution for stream associated *Cycloramphus* (see Heyer and Maxson 1983), particularly in the southern portion of its range. As expected, much of the easily accessible area has been deforested, precluding *Cycloramphus*. We did find a stream with *Cycloramphus* near the town of Rio dos Cedros, Santa Catarina, however. To my knowledge this locality had not been sampled previously; examination of the specimens in the laboratory indicates that they represent a new species, which is named:

Cycloramphus cedrensis, new species

Fig. 4

Holotype.—MZUSP 59260, an adult male from Brazil; Santa Catarina, 12 km E of Rio dos Cedros on road to rio São Bernardo, approximately 26°44'S, 49°20'W. Collected by W. Ronald Heyer on 10 January 1982.

Paratopotypes.—MZUSP 59256–59, USNM 229781–86, same data as holotype, except collected on 9 and 10 January 1982.

Diagnosis.—The other species that share toe webbing and distinct black and/or white dorsal tubercles with the new form are *C. asper*, *boraceiensis*, *duseni*, *izecksohni*, *lutzorum*, *mirandaribeiroi*, *ohausi*, *rhyakonastes*, and *semipalmatus*. *Cycloramphus cedrensis* differs from *C. ohausi* in lacking thumb spines. The considerable web of *C. cedrensis* separates it from *C. duseni*, *rhyakonastes*, and *semipalmatus*, which have reduced webbing, and from *boraceiensis*, *izecksohni*, and *lutzorum*, which have moderate webbing. *Cycloramphus cedrensis* is smaller (males to 44, females to 50 mm SVL) than *mirandaribeiroi* (minimum male size 49, female 62 mm SVL). *Cycloramphus cedrensis* most closely resembles *C. asper* since both have considerable webbing. Most *C. asper* are more fully webbed than *C. cedrensis*: modal web formula for female *C. asper* (female *C. asper* have a little less web than male *asper*) I 0–2⁻ II 0–2⁺ III 0–2½ IV 2⁻–0 V, modal web formula for *cedrensis* I 1–2⁻ II 1–2½ III 1–2½ IV 2½–1 V. The differences in webbing, although difficult to verbalize, are apparent when series of specimens are compared directly.

Description of holotype.—Snout rounded from above and in profile, lip flared; canthus rostralis indistinct; loreal region slightly concave; tympanum hidden; vomerine teeth in almost contiguous transverse series, posterior to choanae; vocal slits present; first finger just shorter than second; outer metacarpal tubercle large, roughly heart-shaped, inner metacarpal tubercle ovoid, separated from thumb subarticular tubercle by distance equal to about ½ diameter of subarticular tubercle; thumbs lacking asperities; dorsal texture rough, with shagreen and larger

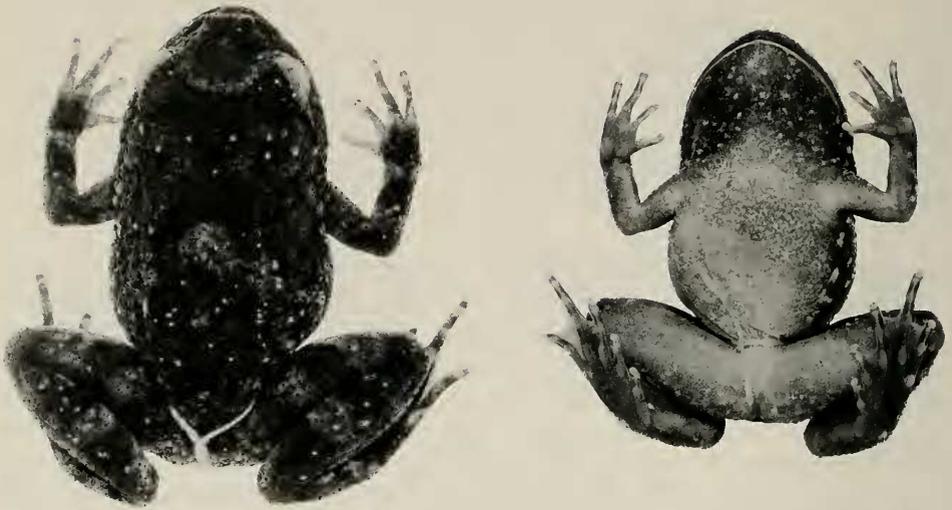


Fig. 4. Holotype of *Cycloramphus cedrensis*, dorsal and ventral views.

and smaller warts bearing black or white tipped tubercles, tubercles and warts not particularly regularly arranged; fold over ear region distinct; inguinal disk large, diameter about $\frac{1}{4}$ length of femur; ventral texture granular; toe tips just wider than digits; toes considerably webbed, I 0–2 II 0–2⁺ III 0–2 IV $2\frac{1}{2}$ –0 V; rounded outer metatarsal tubercle smaller than ovoid inner metatarsal tubercle; no metatarsal fold, a tarsal ridge, but not developed into a fold; outer tarsus with many black tipped tubercles; lateral sole of foot with black tipped tubercles, inner sole smooth.

SVL 40.5, head length 16.1, head width 17.3, eye–nostril distance 4.0, eye–eye distance 8.3, femur 19.5, tibia 18.7, foot 18.7 mm.

In preservation, dorsum brown with indistinct tan mottling; upper lip and loreal region with three very faint light vertical stripes; upper limbs barred; throat brown with white flecks, belly with pattern of small scale brown and white mottle, under limbs more or less uniform brown except for light axillary region on arms; posterior surface of thigh with small regular and irregular light spots.

Variation.—The 5 adult males and 3 adult females range in size from 40.4–43.9 and 41.9–49.9 mm respectively. The paratypes resemble the holotype in most features, but differ in the following features. The posterior surface of the thigh is uniform in one specimen, mottled in three others. Light lip stripes are distinct in two specimens. The belly is uniform in five specimens. Three individuals have the large tuberculate dorsal warts arranged in irregular rows.

The colors in life of USNM 229784 were: chin and chest with small white dots on a maroon background; sides of body and posterior surface of thighs with distinctive small yellow dots; iris very dark brown.

Etymology.—Named for the type locality.

Advertising call.—Call of sporadic single notes; call short, duration 0.06–0.10 s; call not well tuned, maximum energy between 1100–1400 Hz, call pulsatile with sidebands or harmonics of about 200 Hz (Fig. 5).

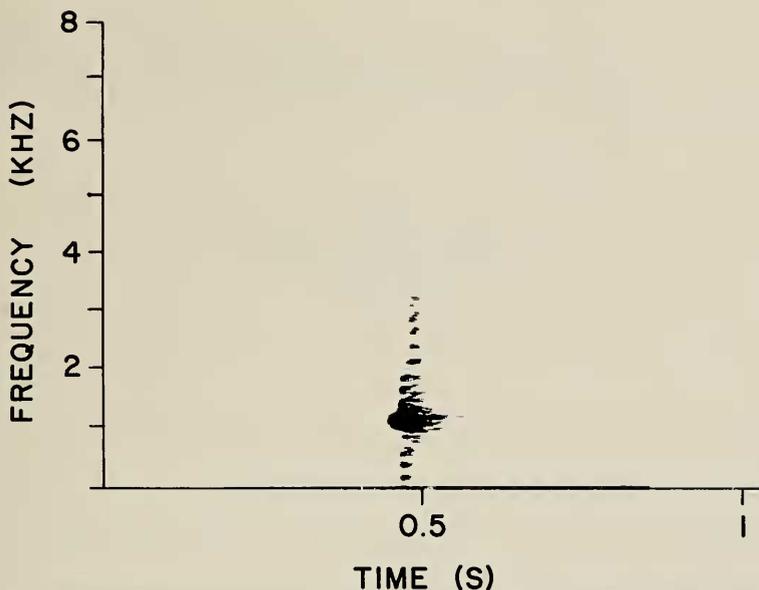


Fig. 5. The advertising call of *Cycloramphus cedrensis*. Recorded while calling from plastic bag. Male individuals in bag were MZUSP 59256–57, 59259–60. Air temperature approximately 27°C.

Larval definition.—Larvae unknown.

Distribution.—Presently known only from the type locality (Fig. 2).

Cycloramphus cedrensis is very similar morphologically to *C. asper* and the two taxa differ only in the degree of webbing. An argument could be made that the population described here as *C. cedrensis* is a geographic variant of *C. asper*. Toe webbing is generally an indicator of species differentiation in the other species of *Cycloramphus* (Heyer 1983; Heyer and Maxson 1983); but the differences in webbing are often more pronounced than in this case. The differences between *C. asper* and *cedrensis* are within the considerably webbed category. The differences are consistent and I interpret them to reflect species differentiation. The two species also differ in life color. The bright yellow spots on the sides of the body and posterior surfaces of the thighs in *C. cedrensis* are very distinctive; *C. asper* has no flash colors. Most *C. asper* are found in the southern half of the Atlantic Forest region in the State of Santa Catarina (Heyer 1983, fig. 30). A single specimen of *C. asper* is known from Serra Alta, near São Bento do Sul in the northern half of the Atlantic Forest region in the State of Santa Catarina

Table 1.—Size ranges (in mm) of adult *Cycloramphus valae* from three localities. Numbers in parentheses are numbers of individuals.

Locality	Males	Females
Gruta	28.7–32.4 (5)	31.0–39.6 (27)
nr. Timbé do Sul	30.4–37.3 (10)	34.9–38.4 (3)
nr. Praia Grande	26.1–32.1 (7)	29.2–34.0 (7)

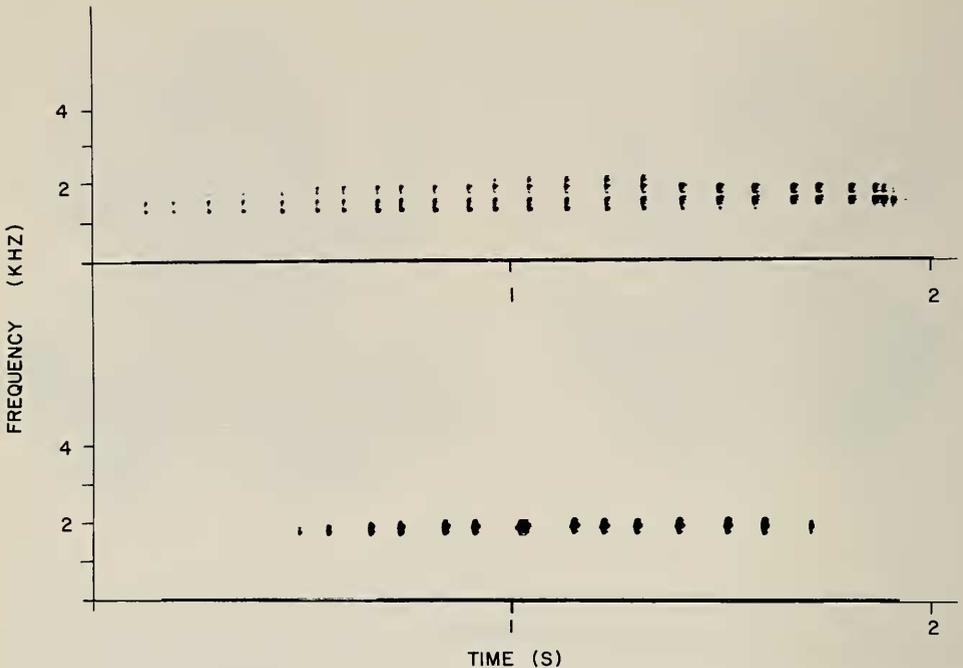


Fig. 6. The advertising call of *Cycloramphus valae*. Upper figure from USNM 229814, Brazil; Santa Catarina, 15 km from Timbé do Sul on road to Bom Jesus (Rio Grande do Sul), 20:45 h, estimated air temperature 18–20° C, 16 January 1982. Lower figure from Brazil; Santa Catarina, 10 km by road from Itaimbezinho to Praia Grande, 20:10 h, 17–18° C, 14 January 1982, specimen not captured.

(Adolfo Lutz previously unnumbered specimen 176, Museu Nacional, Rio de Janeiro). This specimen has not been reexamined for this study, but the webbing formula is consistent with *C. asper*.

No other *Cycloramphus* were found along the stream where *C. cedrensis* was taken. Another species, *C. izecksohni* has been taken from a nearby locality, Timbó do Sul (unnumbered series in E. Izecksohn collection, examined for this study) (Fig. 2, triangle next to hexagon).

New Data for *Cycloramphus valae*

Distribution.—The previously documented southernmost record of *Cycloramphus* was for *Cycloramphus valae* (Fig. 2, northernmost square; the locality reported by Braun and Braun, 1980, for Rio Grande do Sul is in error, see Heyer 1983). The Atlantic Forest Morphoclimatic Domain extends further south than this previous locality record; transects across the southernmost extent of the Atlantic Forest Domain produced two more records for *C. valae* (Fig. 2, two most southern squares). We did not collect the species in the State of Rio Grande do Sul, but further field work is necessary before its absence from the coastal mountain range in northern Rio Grande do Sul is accepted.

There are no noticeable morphological differences among the three available geographic samples of *C. valae*. The southernmost individuals are somewhat

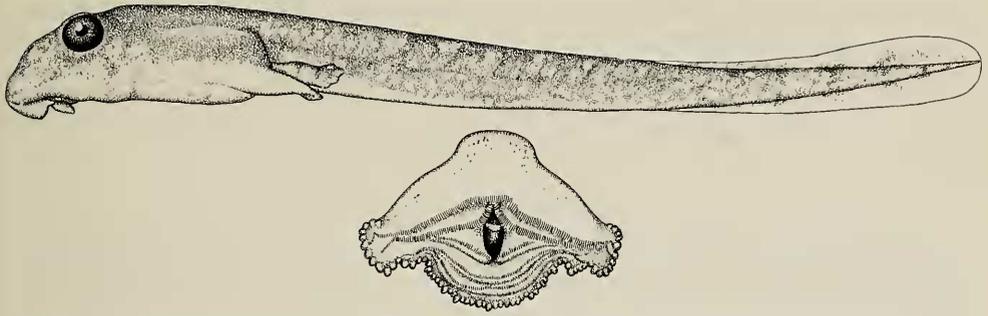


Fig. 7. The larva of *Cycloramphus valae*, USNM 229809, lateral view and mouthparts.

smaller in size than the others, although the difference may be due to sampling error (Table 1).

Advertising calls.—The call of *C. valae* is reported here for the first time. Three calls each were recorded from two individuals, one from near Timbé do Sul (middle square, Fig. 2) and one from near Praia Grande (bottom square, Fig. 2). As the calls differ between localities, they are described separately.

The call of *C. valae* from near Timbé do Sul consists of 23–26 notes lasting from 1.6 to 1.9 s; the dominant frequency ranges between 1250–2250 Hz; each note lasts about 0.02 s; the notes are pulsatile, with sidebands or harmonics of about 100 Hz; the call intensity is modulated, beginning quietly, ending loudly (Fig. 6, top).

The call of *C. valae* from near Praia Grande consists of 16–19 notes lasting from 1.3 to 1.5 s; the dominant frequency ranges between 1750–2200 Hz; each note lasts about 0.02–0.03 s; the notes are pulsatile, with sidebands or harmonics of about 80–100 Hz; the call intensity is modulated, beginning quietly, ending loudly (Fig. 6, bottom).

Additional recordings are not available to determine the degree of intraspecific variation. The calls of the two individuals available differ in degree of call length and number of notes per call. Otherwise, the calls are similar. The similarity of calls suggests that the samples are conspecific, although geographic variation may prove to be present.

Larval definition.—Larvae are elongate and depressed (Fig. 7). The tail fins are low, present only on the distal half of the tail. The belly is flattened and has a shallowly bilobed flap which extends posteriorly past the body. The spiracle, if present, is not visible. The anus is median. The eye is moderately large, 16–19% of the head–body length. The oral disk is broad, 39–41% of the head–body length. The oral disk is entire. The anterior papilla gap is broad, almost the width of the disk. The oral papillae are in a single row, continuous posteriorly. The

tooth row formula is $\frac{1-1}{1-1}$, the split tooth row halves either abutting or overlapping

medially. The beak has strong and deep central cusps. The head–body length is 24–29% the total length. The largest total length is 29.3 mm of a stage 36 (Gosner 1960) larva. The body is uniform dark brown above, mottled on the sides, and

unpigmented below; the tail ranges from almost uniform brown above to a pattern with light dorsal ocelli, the tail venter is unpigmented.

Larvae were collected from water film covered vertical rock walls of a road cut. Of the many tadpoles collected from this habitat at this locality, only three were *C. valae*; the other larvae were all *Thoropa*.

Discussion

The distributional data reported herein do not particularly clarify any zoogeographical patterns aside from establishing the southern distributional limit of *C. valae*. In the latter case, *Cycloramphus* was predicted to occur in the places reported above (Heyer and Maxson 1983), and either *C. valae* or an unknown congener would have been expected to occur in the southernmost part of the generic range. Resolution of the location of the type locality of *C. duseni* removes one zoogeographic enigma caused by faulty map plotting (Heyer 1983). As presently understood, the distributions of *C. asper* and *C. izecksohni* are enigmatic in that each species has a central range with a geographic outlier population. These outlier populations are difficult to explain.

Cycloramphus valae is a member of the *C. granulosus* morphological group (based on adult morphology, Heyer 1983). The relationships of this group lie with the *C. fuliginosus* group: either the groups are closely related or the *granulosus* group is comprised of ectomorph species, each of which has as its closest relative a member of the *fuliginosus* group (Heyer and Maxson 1983). Neither advertising calls nor tadpoles were known for any member of the *C. granulosus* group previous to this report. The larvae share the same derived habitat and morphology as the known larvae of the *C. fuliginosus* group; there is nothing in the larval features to suggest that *C. valae* differs significantly from members of the *fuliginosus* group. The advertising call of *C. valae* differs in kind from the calls known for other members of the *fuliginosus* group. The calls of the *fuliginosus* group consist either of three note calls, the first note differing from the final two, or single note calls (which are similar to the final two notes of the three note call) (Heyer 1983). The call of *C. valae*, in contrast, consists of a multi-note call, similar in overall call pattern to that of *C. ohausi*, the sole representative of the *C. ohausi* group. The individual notes of the *C. valae* call are similar to notes of *fuliginosus* group members in having harmonics or sidebands. The individual notes of *C. ohausi* lack these features. The call of *C. valae* thus combines components found in calls of members of other species groups. Conclusions regarding relationships based on calls must await analysis of this feature in other members of the *granulosus* morphological group.

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George R. Zug (National Museum of Natural History, USNM) also reviewed the manuscript. Field work was supported by the International Environmental Sciences Program, Smithsonian Institution, and the Museu de Zoologia da Universidade de São Paulo.

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